

Hysterosalpingographic (HSG) Pattern of Infertility in Women of Reproductive Age

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ABSTRACT

Background: Infertility is a complex disorder with significant medical, psychological and economic problems. **Aims:** The aim of the study is to evaluate the structural abnormalities of the uterus and fallopian tubes in infertile women as elucidated by hysterosalpingography. **Setting and Design:** A retrospective study, conducted at the Radiology and Obstetric and Gynaecologic Departments of a tertiary health care institution. **Materials and Methods:** Evaluation of all consecutive patients in whom hysterosalpingographic (HSG) was performed for infertility between July 2013 and June 2015 in the Department of Radiology. For the biodata, indications for the investigation and the HSG findings were obtained. **Statistical Analysis:** The data were analyzed using IBM Statistical Package for the Social Sciences (SPSS Inc., Chicago, IL, USA) for Windows, version 20 software. **Results:** A total of 299 patients were evaluated. Of these, 250 were for infertility with primary and secondary infertility constituting 18.4 and 81.6%, respectively. Seventy percent of the cases for infertility had abnormalities on the HSG. Normal uterine cavity was found in 123 (49.2%) cases. Uterine filling defects were the most common uterine abnormality. Fallopian tube occlusion, loculated contrast material spillage and hydrosalpinx were more common on the right, and bilateral tubal occlusion was seen only in 11.2%. All cases of intravasation were associated with either unilateral or bilateral fallopian tube blockage or irregularity of the uterus. **Conclusion:** There was a high incidence of tubal disease in the women presenting with infertility. This was commonly as a result of infection and inflammatory process. This study showed that HSG is very vital in detecting birth canal pathologies; hence, the facility for this important procedure, especially fluoroscopy, should be made available in the health centres for adequate assessment of the women with infertility.

KEYWORDS: Contrast material, fallopian tube, fluoroscopy, hysterosalpingography, infertility, uterus

INTRODUCTION

Infertility is a complex disorder with significant medical, psychological and economic problems. It is defined as the inability of a couple to conceive after 12 months of regular unprotected sexual intercourse.^[1] Infertility is primary if the couples had never been pregnant, whereas secondary infertility is the inability to get pregnant after an earlier pregnancy which may or may not have led to live birth.^[2]

It is estimated that 10–15% of the couples globally experience infertility.^[3] In the United Kingdom and United States, it is estimated to be about 6 and 10%, respectively.^[4] In Africa, its

prevalence is particularly high in the sub-Saharan region, ranging from 20 to 60% of the couples.^[5] This has been attributed to the high rate of sexually transmitted diseases, complications of unsafe abortion and puerperal pelvic infections.^[6] Community-based studies in some parts of Nigeria reported the rates of infertility to be as high as 45%.^[7] It is documented that 15% of all women experience

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primary or secondary infertility at one point in time in their reproductive life. Infertility in women could be caused by disorders at the fallopian tubes, uterus, cervix and ovaries, but more specifically a disorder in the fallopian tubes is the reason for infertility in about 35–40%.^[8] Patent fallopian tubes is a prerequisite for normal human fertility. The fallopian tubes are highly specialized organs. They have a critical role in picking up eggs and transporting eggs, sperm and embryo. The fallopian tubes are also needed for sperm capacitation and egg fertilization. The fallopian tubes are vulnerable to infections and surgical damage, which may impair function by affecting the delicate fimbriae or highly specialized endosalpinx. Fallopian tube patency, morphology of the uterus and cervix are best assessed by hysterosalpingogram, which is simple, safe and inexpensive, compared to the other methods of evaluation of these structures. It has a sensitivity of 65% and a specificity of 83% in detecting tubal blockage.^[9] It has also been suggested that hysterosalpingography has a therapeutic role in enhancing subfertility.^[10] Other imaging modalities which play vital roles in assessing infertility in females include ultrasound and magnetic resonance imaging. Transvaginal ultrasound scan is a standard first choice procedure, which could be complemented by saline or hysterosalpingo contrast sonography (HyCoSy). This has been found to be highly sensitive, specific and accurate in identifying uterine abnormalities or polyps but has limited value in the assessment of tubal abnormalities. Magnetic resonance imaging is also limited in its role in fallopian tube assessment but invaluable in evaluating congenital Müllerian duct anomalies and uterine wall lesions. Hysteroscopy and laparoscopy are other complementary but invasive and expensive procedures for fallopian tubes, uterus and cervix evaluation.^[11]

The aim of the study is to evaluate the structural abnormalities of the uterus and tubes in infertile women as elucidated by hysterosalpingography.

MATERIALS AND METHODS

The study was performed at the Radiology Department and Obstetrics and Gynaecology of a tertiary health institution. All consecutive patients in whom hysterosalpingographic (HSG) was performed for infertility between July 2013 and June 2015 were included. Patients whose medical files, request forms or radiographs were not traceable were excluded. The biodata and indications for the investigation and the HSG findings were obtained.

The study protocol was planned in accordance with the Declaration of Helsinki and was approved by our institutional ethics committee.

Statistical analysis

The data were analyzed using IBM Statistical Package for the Social Sciences (SPSS Inc., Chicago, IL, USA).

Continuous variables were expressed as mean \pm standard deviation and chi-squared test for categorical variables where appropriate.

Hysterosalpingographic technique

The HSG examination was performed at the Radiology Department of our institution by trained radiologists who also interpreted the results thereafter. All the patients provided referral request forms from the gynaecologists or family medicine physicians. Verbal informed consent was obtained from the patient after due explanation of the procedure and possible complications with reassurance. The examination was performed during days 7–12 of the menstrual cycle (day 1 being the first day of menstrual bleeding). This is because the endometrium was thin during this proliferative phase and also facilitated image interpretation and ensured that there was no existing pregnancy. Contraindication for the procedure included pregnancy, active pelvic inflammatory disease, bleeding and severe allergy to iodine-based contrast agents.

The procedure was performed using fluoroscopy. The patient was placed in supine position on the fluoroscopy table, and a scout film of the pelvis was acquired to assess for proper positioning, technical factors and radiopaque pelvic lesions. The patient was placed in lithotomy position. Using aseptic technique, the cervix was visualized with the aid of speculum and the anterior lip held with a Volsellum forceps. A matching size Everard Williams or Leech–Wilkinson uterine cannula was inserted into the endocervical canal after sounding the uterus with a uterine sound. Maintaining a seal between the cannula and cervical canal with gentle traction on the Volsellum and pressure on the cannula, 15–20 ml of water-soluble contrast medium, urografin 76% (sodium amidotrizoate + meglumine amidotrizoate) was injected slowly into the uterine cavity. The appearance of the uterine cavity and patency of the fallopian tubes were assessed by direct image intensification. Spot films during the phases of early uterine filling, tubal filling and peritoneal spill were taken. A release film was taken to check for the clearance of the contrast from the pelvic cavity, especially if there was hydrosalpinx. For the detection of minor deformities of the uterine cavity, it was essential to obtain the radiographs of the uterus in the true anteroposterior projection, and this was achieved by the cervical traction and oblique positioning of the patient where necessary. All HSG examinations were interpreted by the direct visualization of hard copy images, checking for unilateral and bilateral spillage of contrast medium into the pelvic cavity and abnormalities in the outline of the cervix and uterine cavity, which may suggest uterine anomalies.

RESULTS

A total of 299 patients were involved in this study. Of these, 250 were investigated for infertility, whereas 49 were for reasons other than infertility. There were 46 (18.4%) cases of primary infertility and 204 (81.6%) cases of secondary infertility. The age range was 19–44 years, whereas the mean was 32.39 years ($STD \pm 5.39$ years). The mean age of women with primary infertility was 31.73 years, whereas that for the secondary infertility was 32.34 years. Majority of the patients 93 (37.2%) were in the age range of 30–34 years [Table 1].

Seventy-three (29.2%) patients had no pathology, whereas 177 (70.8%) had pathologies in the cervix, uterus, fallopian tubes or in more than one of the structures. Normal uterine cavity was found in 123 (49.2%) cases [Figure 1], 202 (80.8%) cases had smooth outline, whereas

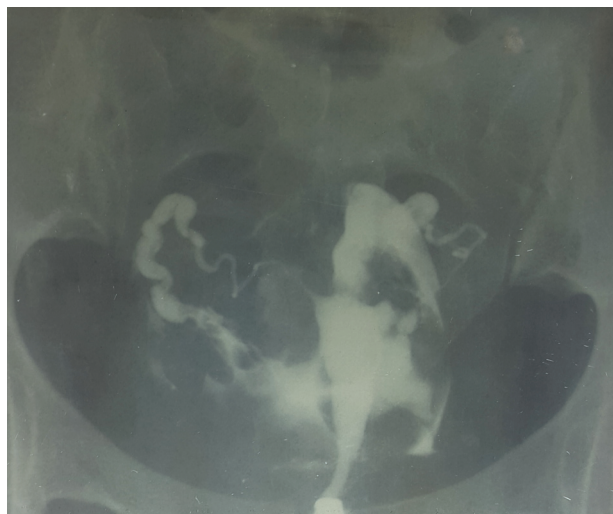


Figure 1: A normal size uterine cavity with both fallopian tubes demonstrated and there was free spillage of the contrast material. Both the cervical canal and the uterine cavity are normal in outline

43 (17.2%) had irregular contour. The uterus was not demonstrable in 4 (1.6%) cases and only one case had unicornuate uterus. The size of the uterus was within normal limits in 169 (67.6%) cases, but large in 54 (21.6%) cases [Figures 2 and 3] and of small size in 23 (9.2%) cases. Uterine filling defects were seen in 78 (31.2%) cases with 34 (13.6%) having synechiae [Figure 4] and 44 (17.6%) having smooth filling defects [Figures 5 and 6B] consisting of intrinsic and extrinsic filling defects [Table 2].

There were 27 (10.8%) cases with uterine leiomyoma on the HSG. Enlarged uterine size [Figure 3] was found in 18 (7.2%), whereas 9 (3.6%) had normal size uterus. None of the cases with small uterine size had leiomyoma. There were only two cases of cervical abnormalities which included synechia and irregularity [Figure 7].

Table 3 shows the HSG pattern of the fallopian tubes; 44 (17.6%) right tubes and 49 (19.6%) left tubes were not demonstrated, whereas 171 (68.4%) and 167 (66.8%) right and left tubes, respectively, were fully demonstrated. There was loculated contrast material spillage in nine and seven cases on the right and the left, respectively. The free spillage

Table 1: Age distribution and indications for hysterosalpingogram

Age in years	Primary infertility	Secondary infertility	Non-infertility indications	Total (%)
15–19	1	0	1	2 (0.67)
20–24	4	14	3	21 (7.02)
25–29	7	43	13	63 (21.07)
30–34	17	76	13	106 (35.45)
35–39	15	52	12	79 (26.42)
40–44	2	19	7	28 (9.36)
Total	46	204	49	299 (100)

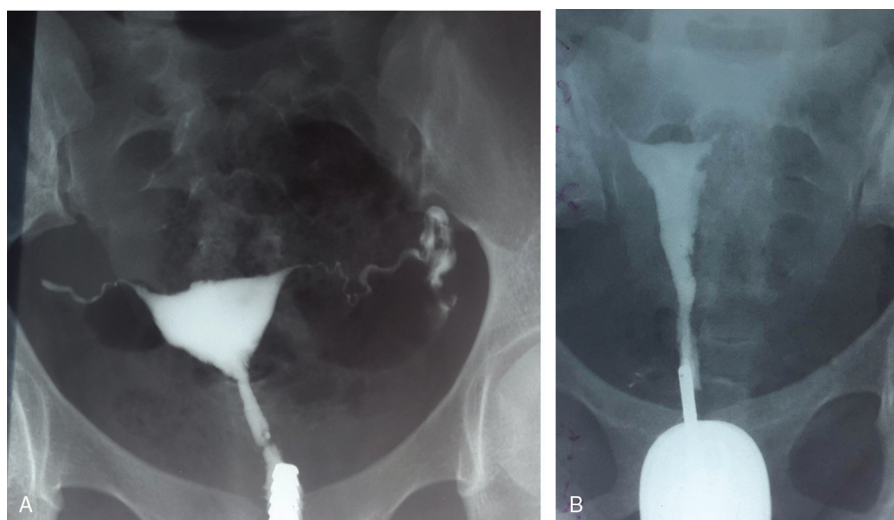


Figure 2: Enlarged uterine cavity with both fallopian tubes occluded

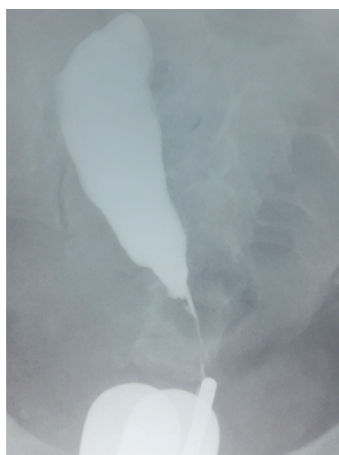


Figure 3: Enlarged, elongated and distorted uterine cavity due to intramural leiomyoma. The fallopian tubes were not demonstrated and there was no contrast material spill into the pelvic cavity



Figure 5: Intrinsic filling defect due to a large submucous uterine leiomyoma



Figure 4: (A and B) Uterine cavity synchia (arrows)

of contrast material was seen in 162 (64.8%) cases on the right and 160 (64%) cases on the left. Bilateral free contrast material spillage was seen in 130 (52%) cases. Tubal occlusion was seen in 19 (7.6%) and 22 (8.8%) cases on the right and the left, respectively. Of these, distal obstruction was the most common abnormality constituting 15 (6%) on the right and 16 (6.4%) on the left. Bilateral tubal occlusion was seen in 28 (11.2%) cases. Hydrosalpinx was found in 16 (6.4%) and 12 (4.8%) cases on the right and left, respectively, with the non-spillage of contrast material being the most frequent on both sides.

Venous intravasation [Figure 8] was noted in 16 (6.4%) cases. All the 16 cases were associated with either unilateral or bilateral fallopian tube blockage or irregularity of the uterus.

DISCUSSION

Though there are other advanced and efficient methods of evaluating the uterine cavity and fallopian tubes in women presenting with infertility, hysterosalpingogram is still widely used because it is cheap, readily available and

Table 2: Frequency distribution of uterine contour and size

Uterine contour and size	Number (%)
Smooth outline	202 (80.8)
Irregular outline	43 (17.2)
Unicornuate uterus	1 (0.4)
Normal size	169 (67.6)
Large size	54 (21.6)
Small size	23 (9.2)
Not demonstrated	4 (1.6)
Synechia	34 (13.6)
Smooth filling defects	44 (17.6)

Table 3: Pattern of fallopian tubes abnormalities

Fallopian tube pattern	Right fallopian tube (%)	Left fallopian tube (%)
Tube not demonstrated	44 (17.6)	49 (19.6)
Fully demonstrated tubes	171 (68.4)	167 (66.8)
Free contrast spill	162	160
Loculated contrast spill	9	7
Tube occlusion	19 (7.6)	22 (8.8)
Cornual obstruction	2	2
Isthmic obstruction	2	4
Distal obstruction	15	16
Hydrosalpinx	16 (6.4)	12 (4.8)
No contrast spill	9	7
Free contrast spill	4	0
Loculated contrast spill	3	5
Total	250 (100)	250 (100)

easy to interpret. It reveals the abnormalities in the cervix, uterus and fallopian tubes at a lower cost and non-invasively. It is readily available and usually the first

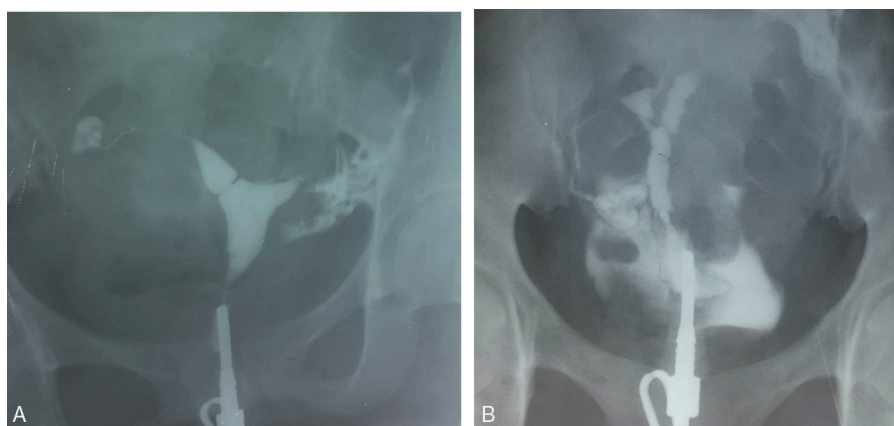


Figure 6: (A) Irregular uterine cavity margin and (B) a ring-like filling defect in the right side of the fundus of the uterine cavity

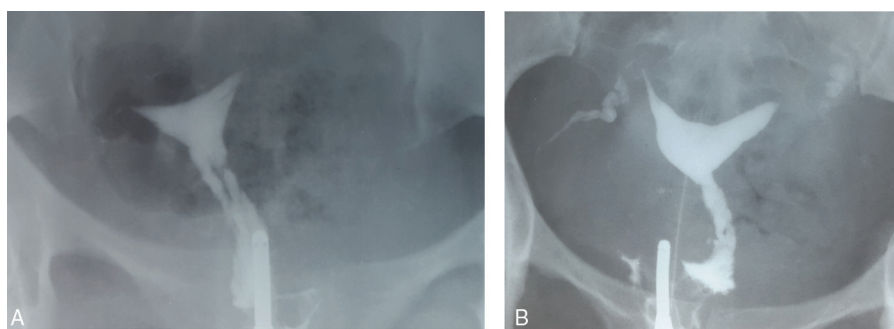


Figure 7: (A) Irregular cervical canal with a linear filling defect. (B) A ring-like filling defect in the cervix and occlusion of the right tube at the isthmus

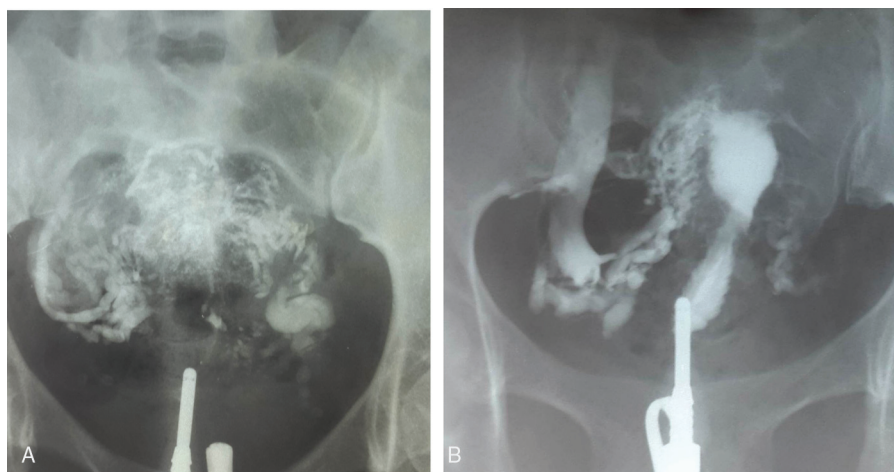


Figure 8: Extensive intravasation in (A) highly scarred uterine cavity and (B) small uterine cavity with bilateral fallopian tubes occlusion

line of imaging evaluation of the fallopian tubes in infertility, especially in developing countries such as ours.

In this study, secondary infertility (81.6%) is more prevalent than primary infertility (18.4%). Similar observations were made by previous researchers.^[11-19] Contrary to our finding, some studies observed that primary infertility is the most common indication for hysterosalpingography in infertile women.^[20,21] One of such studies excluded 90 cases who did not meet the criteria for inclusion and this could have

influenced their findings.^[20] In the same study, the authors expressed alarm over the unexpected finding of cervical and uterine synechiae in patients with primary infertility and wondered if the patients gave valid response to parity, especially because most of the patients may have denied the premarital termination of pregnancy for the fear of marital disharmony.^[20]

This study reveals a mean age of 32.4 years and also showed that the greatest number of the infertile women

presenting for HSG are within the age range of 30–34 years. This is not surprising because it is the peak of the female reproduction stage. Similar mean age was observed in previous studies.^[14,20] Due to increased female education, most females in our environment got married between the ages of 24 and 30 years. If pregnancy is not achieved after marriage, there is more delay at presenting for medical evaluation, because the first line of action was usually dedication to religious activities and prayers. However, after a few years of unsuccessful patience, increased desire to achieve pregnancy and in some cases the increased burden of domestic violence from spouse and in-laws, as she is assumed to be the cause of the problem, leads to submission to medical consultation and investigations.^[11]

The result of the study revealed that 29.2% of the cases had normal HSG findings. This is lower than the 44.2% reported previously in a similar study.^[22] This difference could be attributed to the fact that the previous study was not conducted under fluoroscopy and some of the lesions could have been obliterated by contrast material. Similar studies in Kampala and Nnewi recorded 16.6 and 29.1% of normal findings, respectively.^[18,20]

This study revealed a higher frequency of uterine cavity abnormalities (50.8%) which is similar to the 47% recorded in a similar study in Nnewi^[20] but higher than the 26.8% recorded in a previous study in Port Harcourt.^[22] The low frequency in the previous report in Port Harcourt could be attributed to the reasons mentioned above.

Uterine filling defects were very common in this study constituting 31.2%, most of which were smooth and associated with uterine leiomyoma in 17.6%. Mgbor^[23] and Imo and Adeoye^[12] made similar observations in their studies, with leiomyoma constituting 13.5 and 20%, respectively. Some researchers had contrary findings because they recorded higher frequency in uterine synachiae, which they attributed to infections and excessive uterine curettage.^[13]

Only one (0.4%) case of congenital uterine abnormality was encountered in this study which is close to 3 (0.9%) and 2 (0.8%) cases reported by Danfulani *et al.*^[14] and Akinola *et al.*^[24] respectively, but lower than 10 (3.6%) cases reported by Bukar *et al.*^[13]

This study shows that 130 cases had normal fallopian tubes with free contrast material spillage, whereas 120 (48%) cases had fallopian tube abnormalities. This is comparable to 33.6, 40 and 43.55% fallopian tube abnormalities recorded in previous studies.^[14,15,20]

Bilateral tubal occlusion was seen in 11.2%. This is higher than the 4% previously reported in Port Harcourt^[22] and the 4.5% reported in Sokoto^[14] but close to the 18.7%

reported in Nnewi.^[20] Broeze *et al.*^[25] in a meta-analysis of seven studies on the hysterosalpingography diagnosis of tubal pathologies revealed that the overall prevalence of bilateral tubal pathology was 15% with a range across studies from 9 to 21%. Tubal obstruction was found to be more common on the right 8.8% than on the left 7.6% of the cases. A high frequency of right fallopian tube involvement was also reported by previous researchers^[20,26] who had attributed it to previous appendectomy and its surgical complications. However, in this study, we did not collect data on postsurgical complications. Distal fallopian tube obstruction was the most common form of tubal obstruction. This obstruction is commonly caused by previous pelvic infections and adhesions; previous studies had shown that infections were the most important cause of infertility in our environment.^[23,27-29]

Hydrosalpinx was also noted to be more common on the right. This was seen in 6.4% of the cases and majority showed the absence of contrast material spillage. Similar incidence was reported in previous studies where the incidence of hydrosalpinx ranged from 7.2 to 11%.^[12,23] However, other researchers recorded higher incidences of 20 and 33.1%.^[4,30] Pelvic infections cause adhesions commonly at the ampullary region of the fallopian tubes leading to the blockage of the tubes. The accumulation of secretions within these blocked fallopian tubes causes the tubes to dilate resulting in hydrosalpinx.^[31]

Intravasation occurred in 6.4% of the study population. This is within the prevalence range of 0.4–6.9% reported in previous studies.^[32,33] All the cases of intravasation were associated with either unilateral or bilateral tubal blockage or irregularity of the uterine cavity. Similar findings were reported by Chang and Shim^[34] and Perry,^[35] which they attributed to the increased intrauterine pressure due to the obstruction of the exit of contrast material from the tubes.

In conclusion, there was a high incidence of tubal disease in women presenting with infertility. This commonly would have been as a result of infection and inflammatory process as shown by high distal tubal involvement and hydrosalpinx. The high frequency of complications resulting from pelvic infections could be reduced by female education early in life. The practice of good personal hygiene and the need to seek medical attention with the onset of symptoms should be the emphasis. Aggressive medical care for post-abortion and post-puerperal sepsis should be pursued by the managing physician. Self-medication including assess to antibiotics from pharmacy shops should be discouraged. This study showed that HSG is very vital in detecting birth canal pathologies; hence,

the facility for this important procedure, especially fluoroscopy, should be made available in the health centres for adequate assessment of the women with infertility.

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Conflicts of interest

There are no conflicts of interest.

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